

October 31, 2003

Dr. Andrew Christensen, Chair
Space Science Advisory Committee

Dear Andy,

The Structure and Evolution of the Universe Subcommittee (SEUS) met in public session at the Inn and Conference Center of the University of Maryland on 23-24 October 2003. All current members of the committee were present. As you know, all material presented to the subcommittee may be found on our award-winning website:

<http://spacescience.nasa.gov/admin/divisions/sz/SEUS0310/>.

HST-JWST Transition

The SEU Committee unanimously acknowledges the unique and historic contribution of HST to all of astronomy. This remarkably successful observatory has enriched science and inspired the public for more than a decade. The discoveries it has made have changed the face of astronomy and its influence will be felt long into the future.

We were asked to comment on the HST science transition plan proposed by the Astronomy and Physics Division. Prior to the meeting we had the benefit of reviewing the “Black Panel” report and the HST-JWST Transition Panel report. During the meeting in joint session with the Origins Committee we also heard very thoughtful and comprehensive reports, which we discuss below. We were impressed by the care taken both in the presentation of the proposed Astronomy and Physics Division HST transition plan as well as the presentation of the alternatives considered.

Dr. Kinney presented the proposed Astronomy and Physics Division HST science transition plan, which has two components: complete SM4 and safely de-orbit HST after useful science ceases. The charge to the committee was to comment on this plan.

Following Dr. Kinney’s remarks we heard from Dr. Leckrone, who briefed us on SM4 payload status and alerted us to three critical service elements associated with the SM4 mission: gyroscope, battery, and fine guidance sensor degradation. We took special note that HST has a 50% chance of degrading to a two-gyro state by December 2005.

We next heard from Mr. Burch, who briefed us on the costs and risks associated with a potential SM5 servicing mission. He reviewed with us many alternative scenarios for such a mission. We were impressed by the thoroughness of the study.

Dr. Beckwith convinced us that valuable science could be done with a reduced capability HST: a two science gyroscope mode would buy HST an expected 15 months of science lifetime if SM4 servicing is delayed. In light of Dr. Leckrone’s presentation this could

extend HST's lifetime to March 2007. This is especially important owing to the present uncertainties in the return-to-flight time of the shuttle fleet.

We found Mr. Moore's discussion of propulsion module development studies to be especially helpful. We recognize the need to begin propulsion module development in order to insure that HST can be de-orbited in a controlled manner if, for any reason, HST is not boosted to a higher orbit. We endorse this approach. We note that a shuttle-delivered propulsion module will not be available for a 2005/6 SM4 and would in any case, if included as part of an SM4 mission, displace one or more new science instruments and significantly reduce the science return of SM4. Should SM4 be successful we recommend that the pace and budget profile of the propulsion module development effort be re-evaluated. We note that the need for this capability is agency-wide because there are other orbiting assets that require safe de-orbit and believe that an agency-wide solution should be found.

The committee considered all three of the options described in the HST-JWST Transition Panel report. We note that the Astronomy and Physics Division recommendation is the second of the three options. **The committee reached a consensus that the second option is in fact the correct approach: we endorse completing SM4, operating HST while the observatory is viable and its science capability is compelling and unique, and then de-orbiting the observatory.**

The committee explicitly discussed and rejected the first option of the HST-JWST Transition Panel, which calls for a servicing mission beyond SM4 competed against new space and astrophysics proposals, such as Explorer or Discovery. We were concerned that such a mission would represent a significant departure from the priorities of the astronomical community as described in the recent Decadal report, the Origins roadmap, and the strategic planning process. We feel that any such competition would be intrinsically unbalanced and jeopardize the fast, focused, and agile science investigations that the Explorer and Discovery class represent, and which are so important to the continued vitality and balance of the entire OSS enterprise. **We unanimously endorse the idea that any proposal for a post-SM4 servicing mission should be considered as part of the strategic planning process. We feel that this is proper framework within which the community could consider the merits of a post-SM4 servicing mission in relation to other initiatives.**

HETE-2/SWIFT updates

George Ricker and Don Lamb presented an update on the status of the HETE-2 mission and reviewed recent science highlights. HETE-2 mission operations are currently scheduled to end on January 31, 2004. This was based on the outcome of the 2002 Senior Review. Since this review, several things have happened that support the case for an extension of the HETE-2 operations. First, the launch date for Swift has slipped until mid-May 2004. The 2000 and 2002 Senior Reviews recommended four to six months overlap between HETE-2 and Swift. Without an extension through summer of 2004, this

overlap will not occur. Second, the scientific productivity of HETE-2 has increased significantly since the 2002 Senior Review, and HETE-2 has made or directly enabled several important discoveries about GRB's (including the detection of X-ray line emission from alpha-peak elements in GRB020813 and the firm identification of GRB030329 with a Type Ic core-collapse supernova). Finally, the case for a productive synergy between HETE-2 and Swift appears to be even stronger than at the time of the 2002 Senior Review.

On this basis, the HETE-2 team has proposed two actions. First, they request that HETE-2 mission operations be extended through summer 2004. Second, they request that HETE-2 be invited to participate in the 2004 Senior Review to request a further extension of the mission. As part of the NASA response, the Astronomy and Physics Division has undertaken a mail-based peer review of the first request. **The SEUS supports these actions, and recommends that an extension adequate to provide a four to six month overlap of HETE-2 and Swift be funded, provided that the peer review finds that the scientific basis for this overlap is at least as compelling as was judged by the 2000 and 2002 Senior Reviews. If the advice from the peer review is positive, it appears that it would then be reasonable for HETE-2 to participate in the 2004 Senior Review and be allowed to make the case for a further extension of this mission which is now demonstrated to be productive and scientifically useful.**

SEUS also heard a report on the status of Swift, the next scheduled Space Science launch after GP-B(!!!). The expected launch date has now slipped from December 2003 to May 2004 and the Swift mission status is red. Although Swift has apparently resolved issues related to a required harness modification, there is now a possibility of a further schedule slip because of a conflict with Messenger about the use of the Goddard thermal-vacuum chamber. Although Swift had scheduled the use of the chamber previously, Messenger has a constrained launch window. Code S must make a decision about the relative priorities. The result may be an additional slip in the Swift schedule. SEUS is not qualified to make a recommendation about the relative priorities between Swift and Messenger, and can only recognize that an additional slip in the Swift schedule may entail additional unanticipated budget pressures on Code S to get Swift launched and operational. Swift promises to deliver all the exciting and important gamma ray burst science for which it was designed, and we look forward to its eventual launch and successful science operation.

Astronomy and Physics Working Group

In a joint session with the OS, the SEUS heard a preliminary report of the activities of the Astrophysics Working Group from Doug Richstone. The APWG is concerned about the pending decision to divide R&A funding into separate SEU and ASO budget lines. While we recognize that NASA budgets by themes, we recommend that each of the R&A programs support the best science in both the Astronomical Search for Origins and Structure and Evolution of the Universe themes. Thus while SEU may manage the Astrophysics Theory Program and ASO may manage the IR/Radio R&A program, these

programs should support the best work in all of Astronomy and Physics without regard to whether it falls into the Origins or SEU themes, or even straddles this boundary.

James Webb Space Telescope

The SEUS was pleased to see the amount of progress reported for JWST. In particular, the re-baseline of the mission to meet the cost goals has resulted in significant decisions being made on the mission design, such as choosing beryllium as the material for the primary mirror and optimizing the number of mirror segments. The choices have made JWST more cost-effective without compromising its primary science goals. We congratulate the team on entering Phase B and are happy to see that the project has maintained its schedule for a launch in 2011. We encourage the JWST team to continue making every effort to hold to this schedule, and encourage NASA to continue funding the mission at a level appropriate to this schedule during Phase B.

Joint Dark Energy Mission

We applaud the efforts to date by NASA and DOE in formulating the principles for cooperation and implementation of the Joint Dark Energy Mission. We look forward to continued multi-agency discussions to tackle the important scientific problem of the nature of the mysterious dark energy, and hope that these multi-agency discussions can be broadened to include collaboration on ground-based and theoretical studies, in order that a more complete and coordinated study of dark energy be accomplished, in line with the recommendations in the NRC Committee on the Physics of the Universe report. **We want to encourage the broadest possible representation on the Science Definition Team, in order to establish Science Requirements that are not linked to any particular implementation strategy.** We encourage regular and timely releases of the data that are used for the key science program, as these early releases serve to improve the quality of data for the Dark Energy problem, as well as other science returns from the mission. (For a supernova-based study, these releases could probably occur yearly without sacrificing the statistical integrity of the primary study samples). We also would like to see the Guest Observer program begin in the first year, limited to data that are not part of the key science program. This will greatly improve the science return of the mission.

Several members of the SEUS were able to participate in a tour of some of the facilities at Goddard Space Flight Center. We would like to acknowledge the efforts of many who made the tour possible.

Respectively submitted on behalf of the SEUS,

Rocky Kolb